

Reducing tropospheric ozone with methane controls:

Impact on Arctic radiative forcing



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Acknowledgments:

Larry Horowitz, Dan Schwarzkopf (NOAA/GFDL)

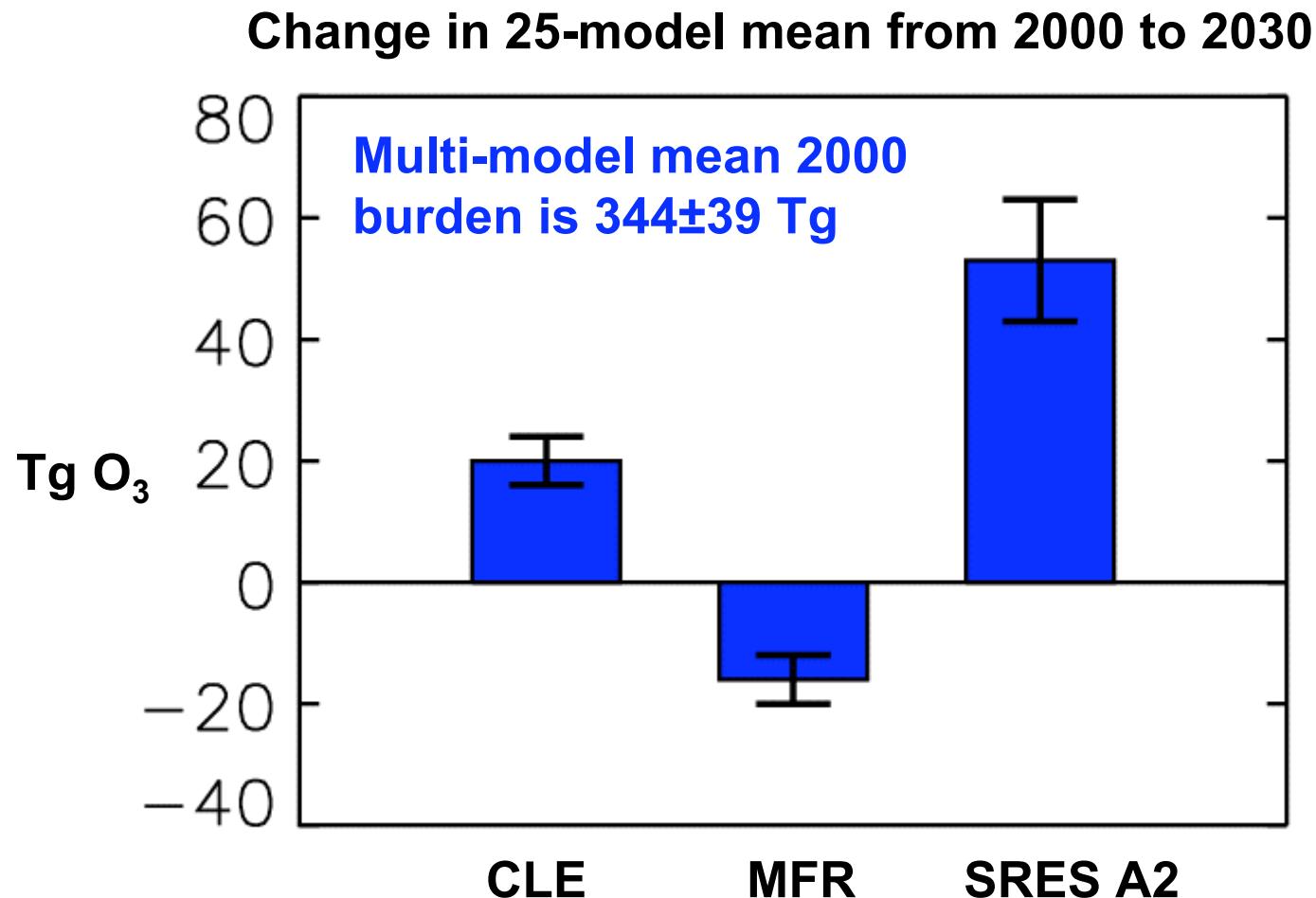
Jason West, Vaishali Naik (Princeton University)

Ellen Baum, Joe Chaisson (Clean Air Task Force)

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Arctic Workshop at NASA GISS, January 8, 2006

Projected changes in tropospheric O₃ burden by 2030



Stevenson et al., JGR, 2006

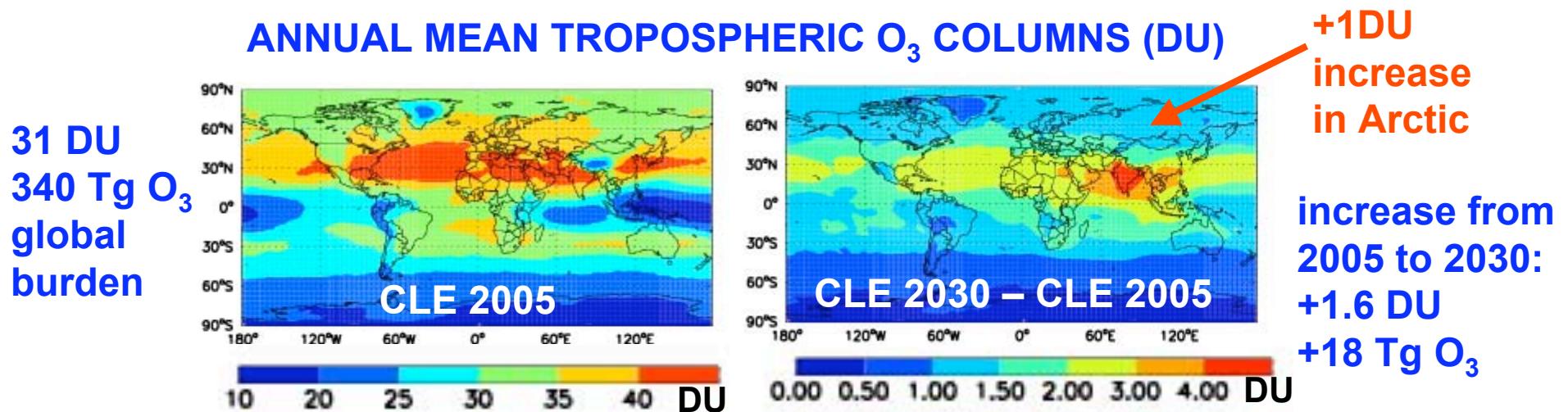
CLE scenario: Changes in emissions and O₃ burden

Anthropogenic emission changes in CLE (2030-2005):

CH₄ +29% (+96 Tg CH₄ yr⁻¹) NO_x +19% (+5.3 Tg N yr⁻¹)
CO -10% (-44 Tg CO yr⁻¹) VOC +3% (+3 Tg C yr⁻¹)

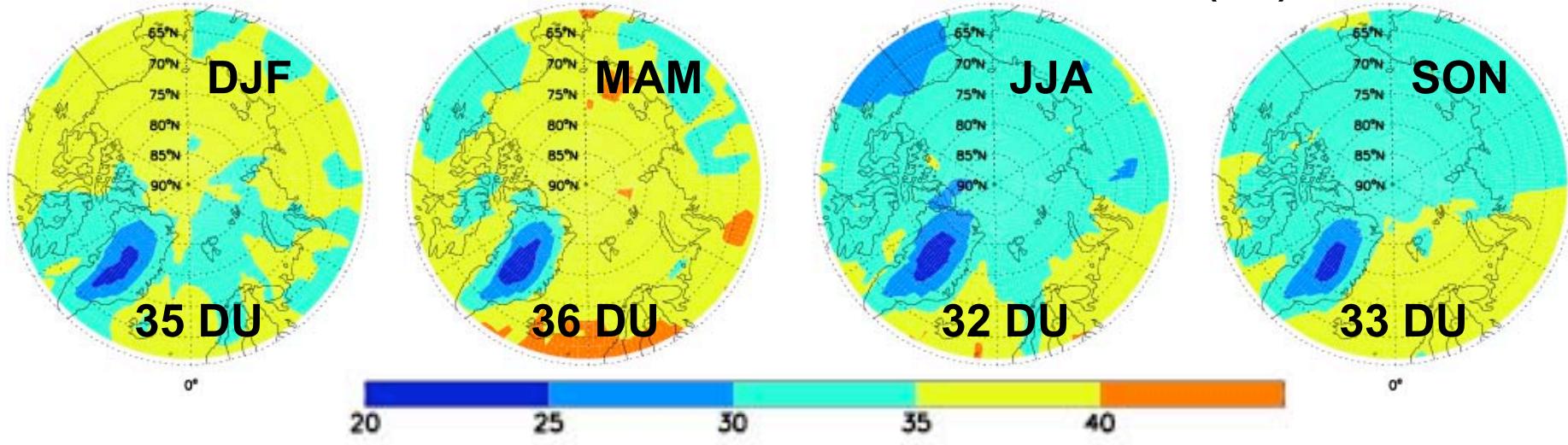


2005 to 2030 transient simulations in MOZART-2 CTM [Horowitz et al., 2003]
2000-2004 NCEP meteorology; 1.9°x1.9°; 28 vertical levels

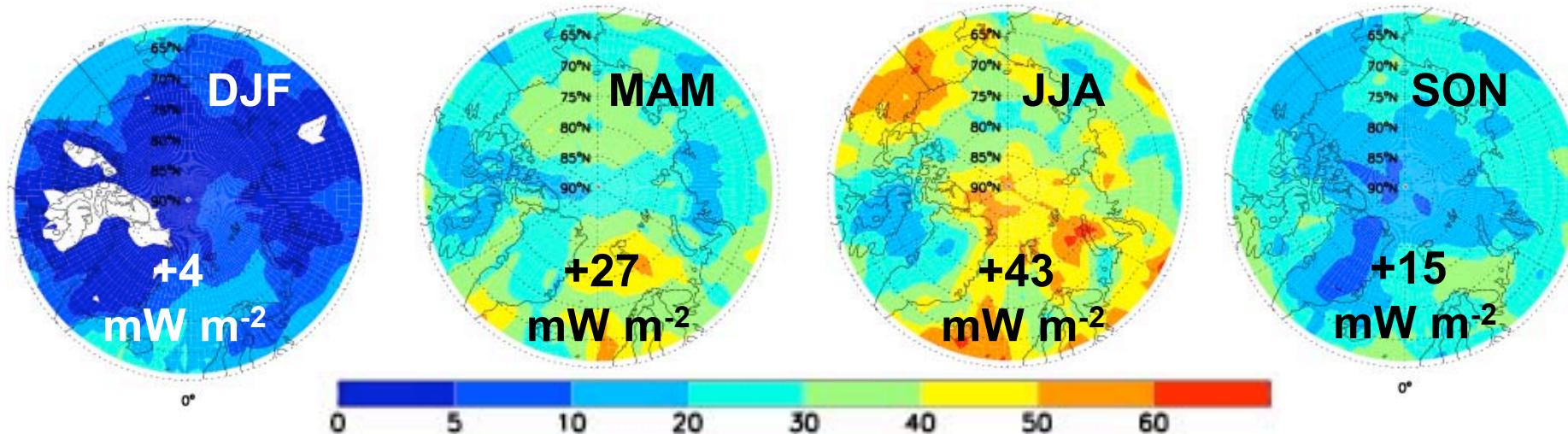


**Arctic O₃ columns highest in winter and spring;
Radiative forcing largest spring and summer**

CLE 2030 TROPOSPHERIC OZONE COLUMNS (DU)

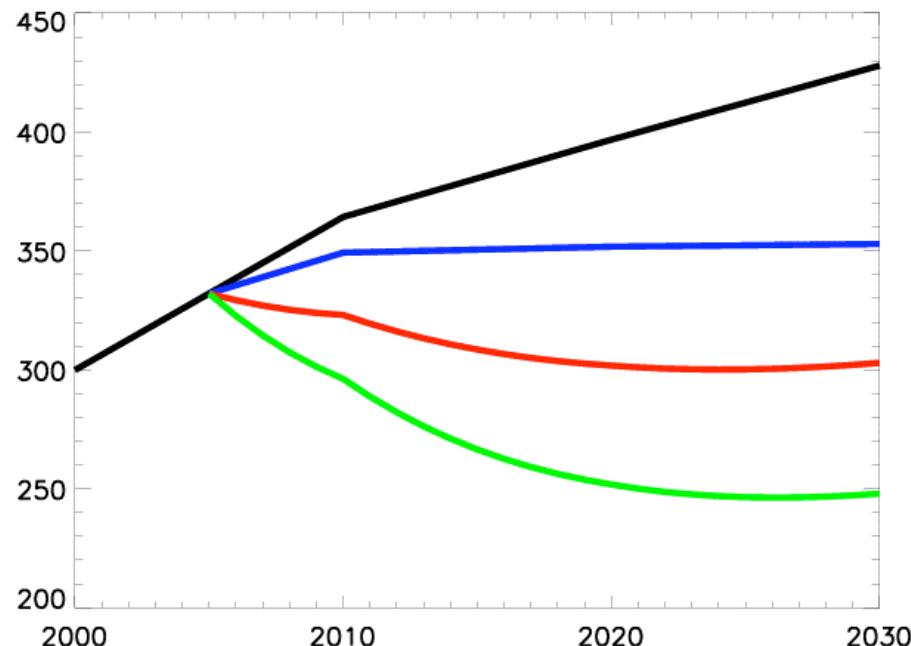


OZONE RADIATIVE FORCING (mW m⁻²) 2005 TO 2030 UNDER CLE SCENARIO



Apply methane controls relative to CLE baseline scenario

Anthropogenic CH₄ Emissions (Tg yr⁻¹)

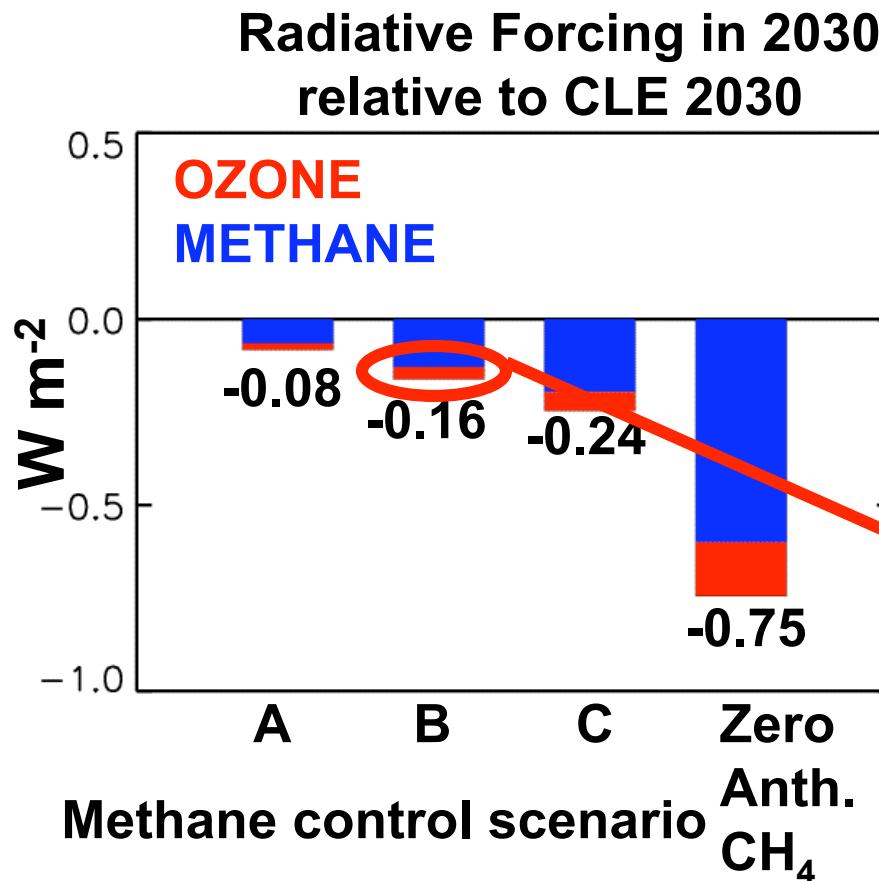


Control scenarios reduce 2030 emissions relative to CLE by:

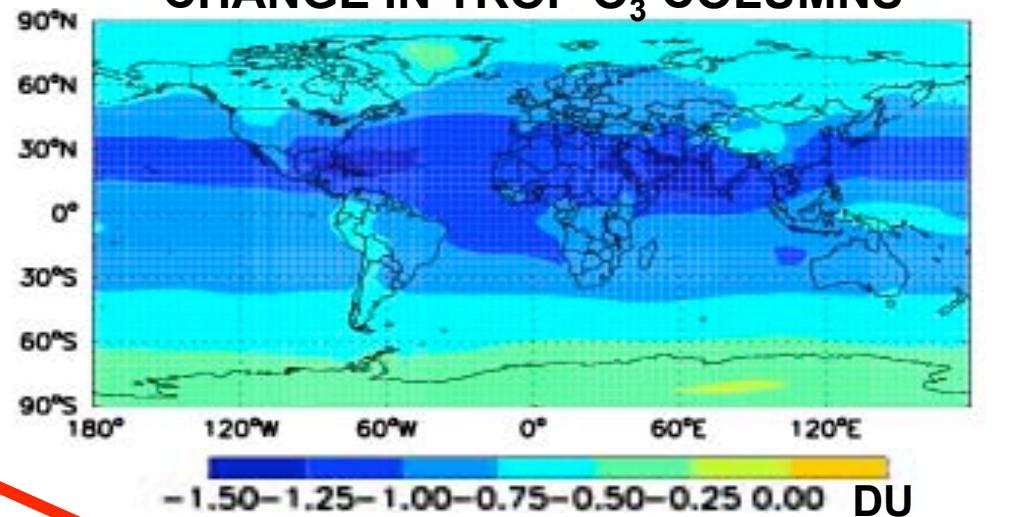
- A) -75 Tg (18%)
- B) -125 Tg (29%)
- C) -180 Tg (42%)

+ 2030 simulation with CH₄ set to 700 ppb pre-industrial level

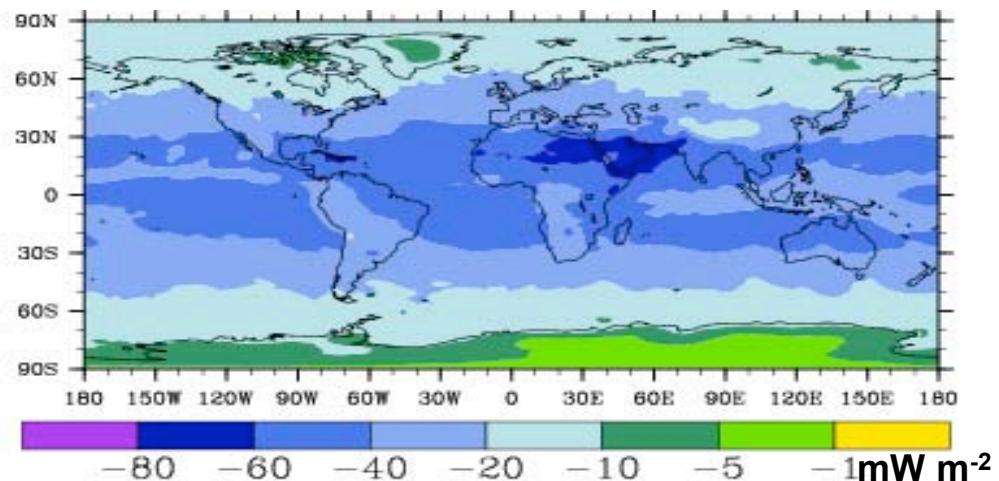
Methane controls reduce global radiative forcing



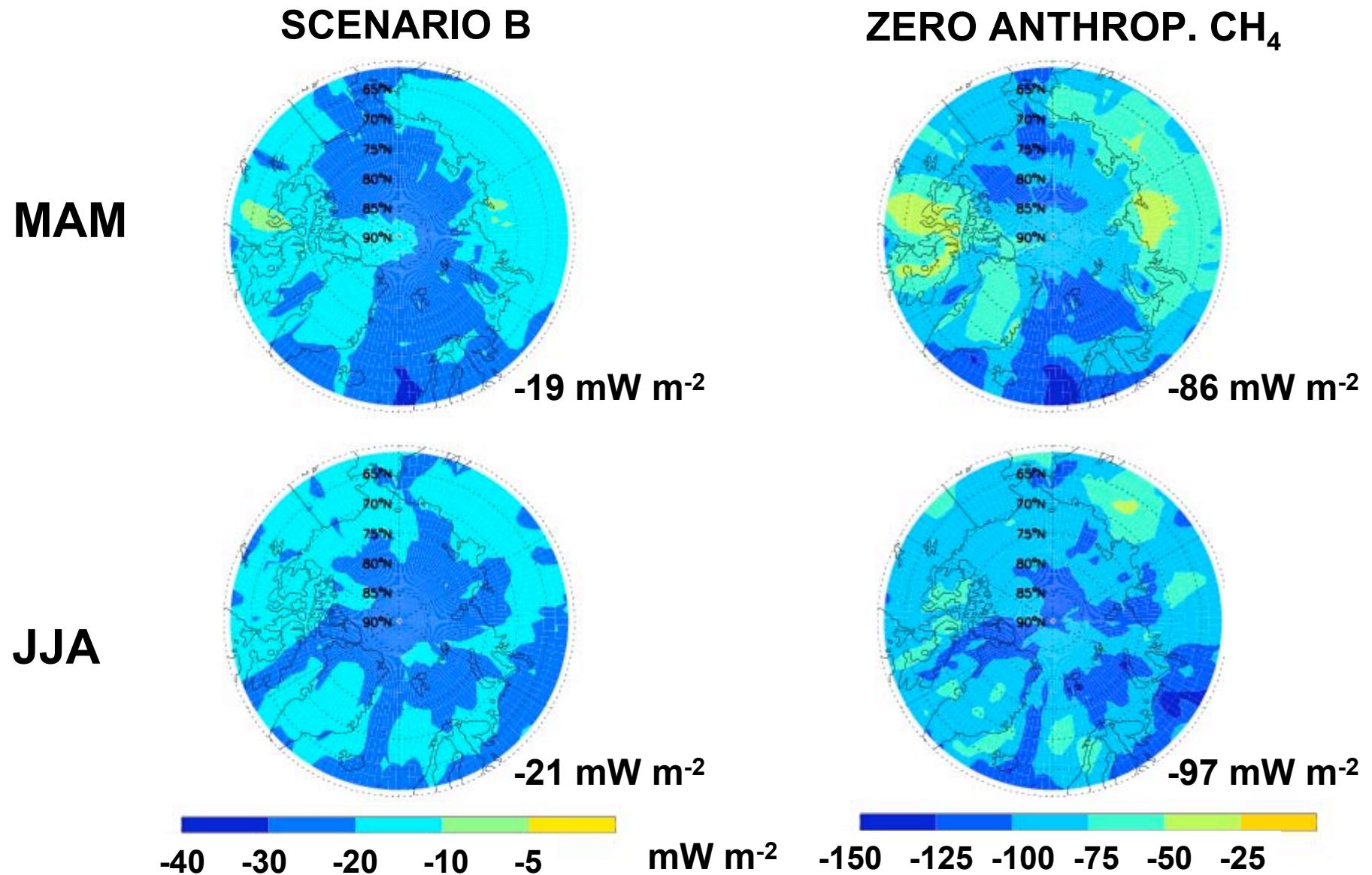
SCENARIO B – CLE BASE 2030
CHANGE IN TROP O₃ COLUMNS



TROPOSPHERIC OZONE FORCING



Methane Controls: Impact on Arctic O₃ radiative forcing



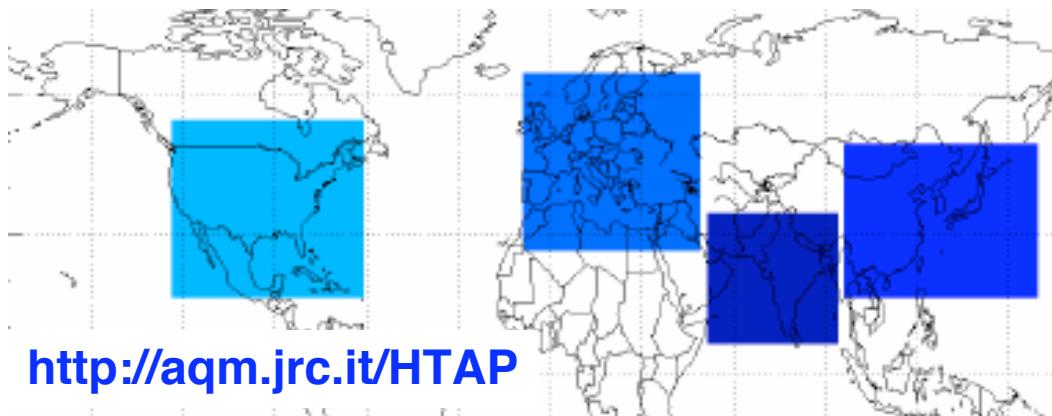
TF HTAP multi-model assessment: The Arctic as a receptor region?



**Task Force on Hemispheric
Transport of Air Pollution**

Co-Chairs: Terry Keating (U.S. EPA), André Zuber (EC)
www.htap.org

Intercontinental Source-Receptor Regions



<http://aqm.jrc.it/HTAP>

~ 13 modeling groups have already delivered results for Experiment 1

20% decreases in anthrop. emissions in HTAP regions:

- NO_x, CO, NMVOC
- aerosols and precursors
- mercury
- POPs

Also 20% decrease in global CH₄ concentration

◊ Opportunity to assess impact of several species from major NH source regions on the Arctic in a consistent way across models

Summary: Impact of methane controls on Arctic ozone radiative forcing

Annual mean changes in the Arctic from 2005 to 2030

